# UE6010

## Time-Code Receiver IC

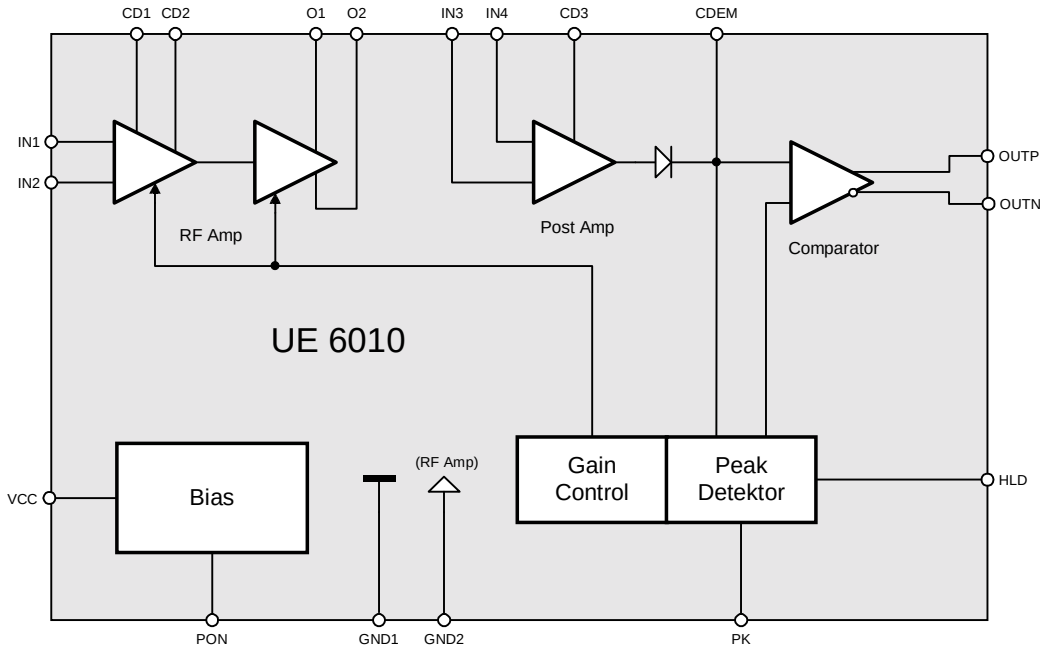
### 1 Short Description

The UE6010 is a bipolar integrated straight through receiver circuit, which is suitable for the frequency range from 40kHz up to 120 kHz (ASK modulation). The receiver with build in very high sensitivity is prepared for single- and multi-band reception and is designed for all kinds of radio controlled clock applications.
Using the corresponding peripheral circuit the IC receives and demodulates time code signals transmitted by e.g. DCF77 (Germany), MSF (UK), WWVB (USA), JJY (JPN), HBG (CH) and BPC (China). By connection of different crystals in the same time it is possible to perform two-, three- or more-band receivers.
Integrated functions as stand by mode, hold mode and complementary output stages offer features for universal applications.

### 2 Features

- Single Chip AM Straight Through Receiver
- allows the design of single-, dual- or multi-band receivers
- Low power consumption
- Very high sensitivity ( typ. 0.3µV )
- High selectivity by using crystal filter
- Power down mode available
- Only a few external components necessary
- Complementary current output stages
- AGC hold mode
- Wide frequency range (40 ... 120 kHz)
- Low power battery applications (1.1 .. 3.6 V)

### 3 Block Diagram



## 4 Ordering Information

| Extended Type Number | Package | Remarks |
|---|---|---|
| UE6010 DIT | No | Die in trace |

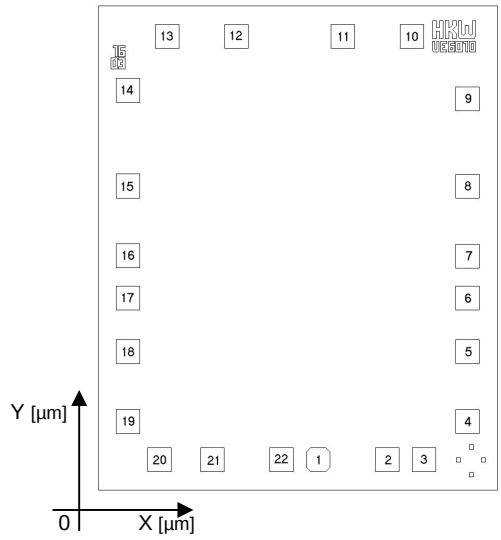
## 5 Pad Layout and PAD Coordinates

The UE6010 is available as DIE for "chip-on-board" mounting.

DIE size: 1840 µm x 2210 µm
Thickness: 460 µm

PAD size: 110 µm x 110 µm
min. pad-distance: 146 µm
min. pad-pitch: 256 µm

Note:
Pad coordinates are refered to the center point of each pad.




reference point (origin)

| Symbol | Function | x-axis (µm) | y-axis (µm) | Pad # (dice) |
|---|---|---|---|---|
| GND2 | Ground 2 (RF stages) | 1104.0 | 219.0 | 1 |
| CD1 | Decoupling capacitor C1 | 1426.0 | 219.0 | 2 |
| CD2 | Decoupling capacitor C1 | 1597.0 | 219.0 | 3 |
| IN 1 | Antenna input 1 | 1801.0 | 396.0 | 4 |
| IN 2 | Antenna input 2 | 1801.0 | 718.0 | 5 |
| VCC | Supply voltage | 1801.0 | 964.0 | 6 |
| | n.c. | 1801.0 | 1157.0 | 7 |
| OUTP | Data output (positive) | 1801.0 | 1479.0 | 8 |
| OUTN | Data output (negative) | 1801.0 | 1881.0 | 9 |
| | n.c. | 1541.0 | 2170.0 | 10 |
| GND1 | Ground 1 (other stages) | 1219.0 | 2170.0 | 11 |
| HLD | AGC stop | 724.0 | 2170.0 | 12 |
| PON | Power on input | 402.0 | 2170.0 | 13 |
| PK | Peak detector output | 219.0 | 1920.5 | 14 |
| CDEM | Demodulation capacitor | 219.0 | 1480.0 | 15 |
| | n.c. | 219.0 | 1158.0 | 16 |
| | n.c. | 219.0 | 964.0 | 17 |
| CD3 | Decoupling capacitor C2 | 219.0 | 718.0 | 18 |
| IN3 | Crystal input 1 | 219.0 | 396.0 | 19 |
| IN4 | Crystal input 2 | 365.0 | 219.0 | 20 |
| O2 | Crystal RF output 2 | 611.0 | 219.0 | 21 |
| O1 | Crystal RF output 1 | 933.0 | 219.0 | 22 |

## 6 Internal connection of PAD's

The IC is ESD protected conform to the Human-Body-Model ($\pm V_{ESD}$ =2000V on each pin refered to GND1). Ground-Pins GND1 and GND2 are internally connected to each other via the IC-substrat. We recommend to connect these pins (extern) on the PCB too.

## 7 Functional description of PAD's

### IN 1 Antenna input 1

Both antenna inputs, IN1 and IN2, are entitled to the same rights. It is possible to realize a symmetrical operation as well as an unsymmetrical operation of the connected ferrit-antenna.

- unsymmetrical operation mode:

The HF-signal is supplied into the input IN1. The coil of the ferrit-antenna has to be connected between VCC and input IN1. Pin IN2 should be connected to VCC.

- symmetrical operation mode:

Recommended operation mode if the application is influenced by bigger disturbances. The coil of the ferrit-antenna has to be connected between IN1 and IN2. External resistors are needed to adjust the operation condition.

### IN 2 Antenna input 2

The connection of IN2 is similar to that explained for IN1 .

### IN 3 Crystal input 1

High resistance input of an amplifier stage. An external crystal has to be connected to IN3 to supply the filtered signal into this amplifier.

### IN 4 Crystal input 2

Input used to adjust the receiver for single- or multi-band reception in correspondence to the no. of connected crystals.

### PON Power ON input

If PON is connected to GND, the receiver will be activated. If PON is connected to $V_{CC}$, the receiver will switch to power-down mode.

### CD1 Decoupling capacitor C1

A capacitor is connected between CD1 and CD2. It stabilizes the operation point of the input amplifier.
Expected capacitor-values: about 10 … 33nF.

### CD2 Decoupling capacitor C1

As described for Pin CD1.

### CD3 Decoupling capacitor C2

Capacitor C2 (100nF to VCC) is used to stabilize the operation point of an intermediate amplifier.

### HLD AGC hold

AGC hold mode: HLD high ($V_{HLD} = V_{CC}$) sets normal function, HLD low ($V_{HLD} = 0$) holds for a short time the AGC voltage. This can be used to prevent the AGC from peak voltages, created by e.g. a stepper motor.

### O1 Crystal RF output 1

At the output O1 you find the amplified HF-signal. O1 is connected to the crystal 1 filter.

### O2 Crystal RF output 2

At the output O2 you find the amplified HF-signal. O2 is connected to the crystal 2 filter.

### OUTP positive Data output

At the data output pin OUTP you find the demodulated time code signal. Output signal pulses on this pin will be HIGH-active. OUTP is a complementary current output stage. The output driving capability is about +/- 2.5µA.

### OUTN negative Data output

At the data output pin OUTN you find the demodulated time code signal. Output signal pulses on this pin will be LOW-active. OUTN is a complementary current output stage. The output driving capability is about +/- 2.5µA.

**PK Peak Detector output**
An external capacitor has to be connected between pin PK and GND. This ensures the function of the peak detector. The value of the capacitance (≥ 2.2µF) influences the AGC regulation time.

**CDEM Demodulation capacitor**
Demodulator output. An external capacitor (22nF) has to be connected between pin CDEM and GND. It is used to demodulate the filtered and amplified HF-signal.

**VCC Supply voltage**
Positive power supply voltage of the IC.

**GND1 Ground 1**
GND1 is the reference potential for all IC-stages (excluding some amplifier stages) and for the internal ESD protection circuit.

**GND2 Ground 2**
GND2 is the reference potential for some amplifier stages (including the HF-amplifier).

## 8 Absolute Maximum Ratings

(for $T_{amb}$ = -25 … 85°C)

| Pos. | Parameters | Symbol | min. value | max. value | Unit |
|---|---|---|---|---|---|
| 1 | Supply voltage | $V_{CC}$ | 0 | 5.5 | V |
| 2 | allowed voltage on each pin | $V_{PIN}$ | -0.3 | $V_{CC}$ + 0.3 | V |

## 9 Operation Ratings

### 9.1 Operation Range 1

| Pos. | Parameters | Symbol | min. value | max. value | Unit |
|---|---|---|---|---|---|
| 1 | operation supply voltage | $V_{CC}$ | 1.1 | 3.6 | V |
| 2 | Ambient temperature range | $T_{amb}$ | 0 | 50 | °C |

### 9.2 Operation Range 2

| Pos. | Parameters | Symbol | min. value | max. value | Unit |
|---|---|---|---|---|---|
| 1 | operation supply voltage | $V_{CC}$ | 1.5 | 3.6 | V |
| 2 | Ambient temperature range | $T_{amb}$ | -25 | 85 | °C |

# 10 Electrical Characteristics

## 10.1 DC-Characteristics

test-circuitry shown in chapter 11
$V_{CC}$ = 3V ; $T_{amb}$ = 25 °C
$V_{PON}$ = 0V ; $V_{STOP}$ = $V_{CC}$
input signal $V_{IN1}$, $V_{IN2}$ = $V_{CC}$ ; f = 77.5 kHz ± 5 Hz;
AM carrier voltage reduction from 100% to 25% for $t_{MOD}$ = 200ms, unless otherwise specified.

| Pos. | Parameter | Test condition | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| 1 | Quiescent current receiver OFF | $V_{PON} = V_{CC} = 3V$ | $I_{CC0}$ | | | 1 | µA |
| 2 | Supply current; receiver ON | | $I_{CC}$ | 300 | | 600 | µA |
| 3 | switch current receiver ON | $V_{PON} = 0V$ | $-I_{PON}$ | | | 20 | µA |
| 4 | switch current; AGC in hold mode | $V_{HLD} = 0V$ | $-I_{HLD}$ | | | 2 | µA |
| 5 | output current (OUTx, high) | $V_{OUTx} = V_{CC} / 2$ | $I_{OUTx}$ | | | 2.5 | µA |
| 6 | output current (OUTx, low) | $V_{OUTx} = V_{CC} / 2$ | $-I_{OUTx}$ | | | 2.5 | µA |

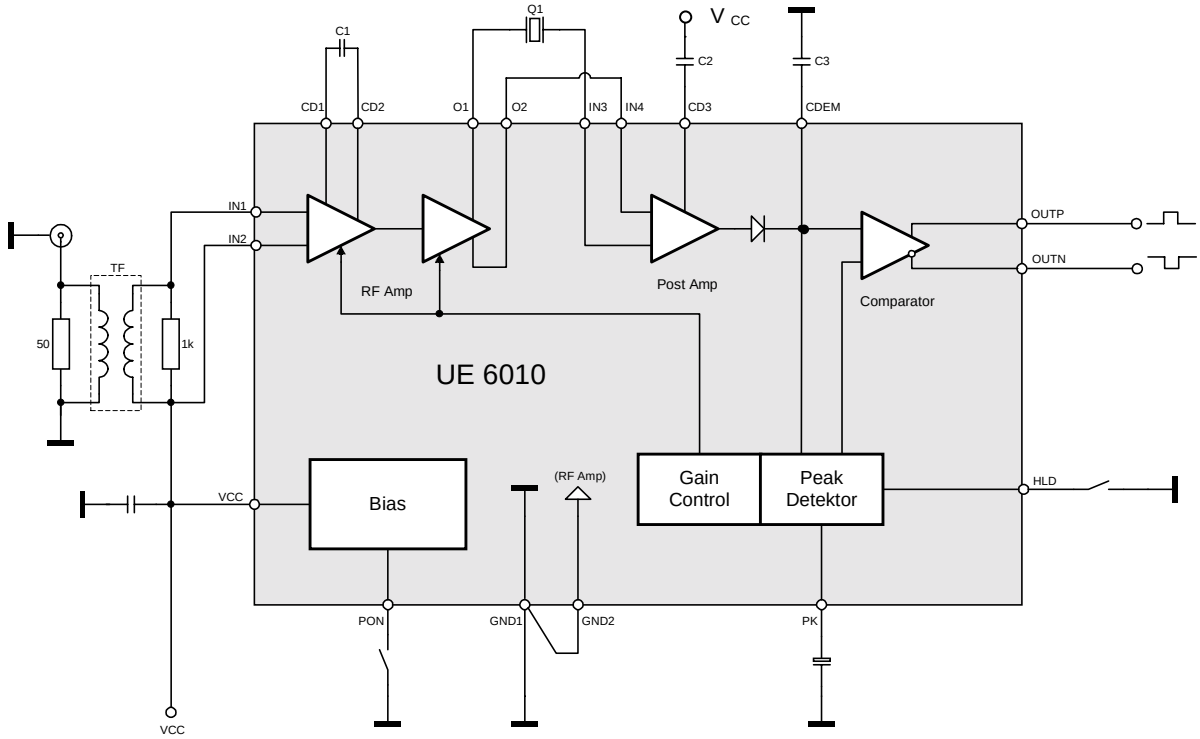
## 10.2 AC-Characteristics

test-circuitry shown in chapter 11
$V_{CC}$ = 3V ; $T_{amb}$ = 25 °C
$V_{PON}$ = 0V; $V_{STOP}$ = $V_{CC}$
input signal $V_{IN1}$, $V_{IN2}$ = $V_{CC}$ ; f = 77.5 kHz ± 5 Hz;
AM carrier voltage reduction from 100% to 25% for $t_{MOD}$ = 200ms, unless otherwise specified.

| Pos. | Parameter | Test condition | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| 1 | Minimum input voltage | | $V_{IN\ min}$ | | 0.3 | 0.5 | $\mu V_{RMS}$ |
| 2 | Maximum input voltage | | $V_{IN\ max}$ | 30 | | | $mV_{RMS}$ |
| 3 | Output pulse width [1)] | $t_{MOD}$ = 100ms | $t_{WO100}$ | 70 | 95 | 130 | ms |
| | | $t_{MOD}$ = 200ms | $t_{WO200}$ | 170 | 195 | 230 | ms |
| 4 | Set-up time after PON | $V_{IN}$ = 100µV | t | 3 | | 5 | s |

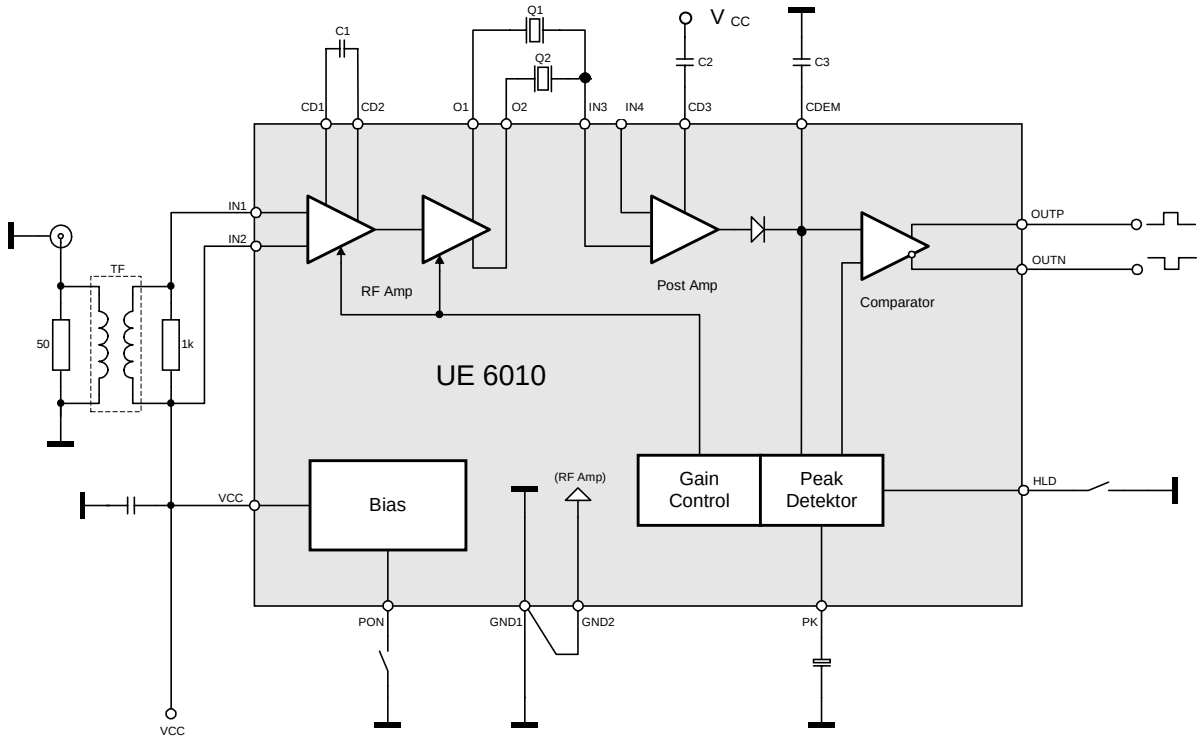
[1)] specified for operation range 1

## 11 **Test Circuitry** (application as single receiver, to receive one defined radio station)




(TF: Schalenkern $A_L$ 1100 nH/w²; 2*25 Wdg. mit 0,2 CuL)

## 12 **Test Circuitry** (application as twin receiver, to receive two different radio stations)




(TF: Schalenkern $A_L$ 1100 nH/w²; 2*25 Wdg. mit 0,2 CuL)

## 13 Application hints

Please refer to the separate document “UE6010-AE Vx.x” including various application hints.

## 14 Disclaimer of Warranty



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